Nos. 2014-1087, 2014-1088

United States Court of Appeals
for the Federal Circuit

HAREN S. GANDHI, JOHN VITO CAVATAIO,
ROBERT HENRY HAMMERLE, YISUN CHENG,
Appellants,

v.

BRIGITTE BANDL-KONRAD, ANDREAS HERTZERG, BERND KRUTZSCH,
ARNO NOLTE, MARKUS PAULE, STEFAN RENFFTLEN,
NORBERT WALDBUESSER, MICHEL WEIBEL,
GUNTER WENNINGER, ROLF WUNSCH,
Appellees.

Appeal from the Patent Trial and Appeal Board in Interference No. 105,839, Administrative Patent Judge Hung H. Bui.

BRIEF OF APPELLEES

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February 27, 2014

CERTIFICATE OF INTEREST

I, Michael H. Jacobs, certify the following:

1. The full name of every party or amicus represented by me is:

Brigitte Bandl-Konrad, Andreas Hertzberg, Bernd Krutzsch, Arno Nolte, Markus Paule, Stefan Renfftlen, Norbert Waldbuesser, Michel Weibel, Guenter Wenninger, and Rolf Wunsch.

2. The name of the real party in interest (if the party named in the caption is not the real party in interest) represented by me is:

Daimler AG.

3. All parent corporations and any publicly held companies that own 10% or more of the stock of the party or amicus curiae represented by me are:

None.

4. The names of all law firms and the partners or associates that appeared for the party or amicus now represented by me in the trial court or agency or are expected to appear in this court are:

Crowell & Moring LLP: Michael H. Jacobs, Stephen W. Palan, and Jeffrey Ahdoot.

February 27, 2014

Respectfully submitted,

/s/ Michael H. Jacobs

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TABLE OF ABBREVIATIONS

Andreasson '809 publication	International Patent Publication No. 99/39809
Bandl- Konrad	Brigitte Bandl-Konrad, Andreas Hertzerg, Bernd Krutzsch, Arno Nolte, Markus Paule, Stefan Renfftlen, Norbert Waldbuesser, Michel Weibel, Guenter Wenninger, and Rolf Wunsch
Bandl-Konrad '747 patent	U.S. Patent No. 7,814,747
CO_2	Carbon dioxide
Cooper '487 patent	U.S. Patent No. 4,902,487
Gandhi	Haren S. Gandhi, John Vito Cavataio, Robert Henry Hammerle, and Yisun Cheng
Gandhi '470 application	U.S. Patent Application Serial No. 10/065,470, which published as U.S. Patent Application No. 2004/0076565
Gandhi '558 application	U.S. Patent Application Serial No. 12/706,558
Khair '096 patent	U.S. Patent No. 6,293,096
Kinugasa '024 patent	U.S. Patent No. 6,109,024
LNT	"Lean nitrogen oxide trap," "nitrogen oxide storage catalytic converter," "NO_x absorber catalytic converter," NO_x trap," "lean NO_x trap," or "lean NO_x
NH_3	Ammonia
NO_2	Nitrogen dioxide
NO	Nitrogen monoxide
NO_x	Nitrogen oxide
Opinion	July 26, 2013 Opinion, *Brigitte Bandl-Konrad et al. v. Haren S. Gandhi et al.*, Patent Interference No. 105,839 (P.T.A.B.) (Paper No. 125)
Pieplu article	*Claus Catalysis and H_2S Selective Oxidation* by Anne Pieplu
PTAB	Patent Trial and Appeal Board and Board of Patent Appeals and Interferences
SCR	Selective catalytic reduction
SCR catalyst	"SCR catalytic converter" or "NH_3-SCR catalyst"
Tennisson '806 patent	U.S. Patent No. 6,928,806
Twigg '647 publication	International Publication No. 00/21647

STATEMENT REGARDING ORAL ARGUMENT

Appellees Brigitte Bandl-Konrad, Andreas Hertzerg, Bernd Krutzsch, Arno Nolte, Markus Paule, Stefan Renfftlen, Norbert Waldbuesser, Michel Weibel, Guenter Wenninger, and Rolf Wunsch (collectively, "Bandl-Konrad") request oral argument.

STATEMENT OF RELATED CASES

No previous appeals have been taken from this case to any appellate court. Counsel is unaware of any cases pending in this or any other court that will directly affect or be affected by this Court's decision in this appeal.

JURISDICTIONAL STATEMENT

Bandl-Konrad agrees with the jurisdictional statement of Appellants Haren S. Gandhi, John Vito Cavataio, Robert Henry Hammerle, and Yisun Cheng (collectively, "Gandhi").

STATEMENT OF ISSUES

Whether the Patent Trial and Appeal Board ("PTAB") correctly found that claims 1-8, 10, 16, 17, and 19 of U.S. Patent No. 7,814,747 are patentable where there is substantial evidence that the particular arrangement of exhaust gas

purification components recited in these claims is not disclosed by the prior art and the prior art taught away from the particular claimed arrangement of components.[1]

STATEMENT OF THE CASE

This appeal is from a patent interference declared by the U.S. Patent and Trademark Office's Patent Trial and Appeal Board ("PTAB")[2] between U.S. Patent Application Serial No. 12/706,558 ("the Gandhi '558 application") and U.S. Patent No. 7,814,747 (the "Bandl-Konrad '747 patent"). The Gandhi '558 application discloses the basic – and long-known – technology of purifying exhaust gas emissions by providing alternating rich and lean exhaust gas to a combination of a nitrogen oxide storage catalytic converter ("NO_x catalytic converter" or "LNT") and a downstream SCR catalyst. The Bandl-Konrad '747 patent discloses this well-known technique, as well as highly significant improvements to this technology. Gandhi has conceded that none of its claims are patentable, but has nonetheless appealed in an attempt to cancel Bandl-Konrad's claims 1-8, 10, 16, 17, and 19.

[1] Although Bandl-Konrad raised various issues for cross-appeal in its Docketing Statement, Bandl-Konrad has decided not to pursue a cross-appeal.

[2] The PTAB was known as the Board of Patent Appeals and Interferences at the time the interference was declared, as well as at the times the various court decisions discussed herein were issued. For the sake of convenience, PTAB will be used herein to describe both entities.

I. Background

A. Summary of the Technology

Automobile emissions and fuel efficiency have long been regulated by government agencies, and reducing pollution and improving fuel efficiency in automobiles continue to be technological challenges for the automotive industry. JA2507, ¶ 13. Automobile emissions are regulated because the internal combustion process in engines produces certain exhaust gas pollutants including carbon monoxide, hydrocarbons, particulate matter, and nitrogen oxides (NO_x), such as nitrogen monoxide (NO)and nitrogen dioxide (NO_2). JA0097, col. 9, ll. 4-9; JA2394, ¶ 19; JA2507, ¶ 14.

Since the early 1970s, catalysts have been widely used in automobile exhaust gas systems in attempt to convert polluting gases into non-polluting gases, such as carbon dioxide (CO_2), water (H_2O), and nitrogen (N_2). JA2507, ¶ 15.

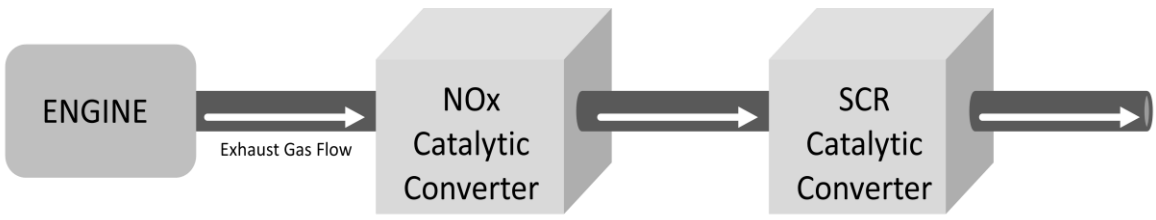
In addition to problems with exhaust gas pollutants, the automobile industry has also been concerned with addressing fuel efficiency. *Id*., ¶ 16. One technique used to improve fuel efficiency was to increase the air-to-fuel ratio for more efficient fuel combustion in the cylinders of an internal combustion engine. *Id*. When more fuel than air is present, the mixture is called "rich," and where there is more air than fuel present, the mixture is called "lean." JA2507-08, ¶ 16. Feeding

an engine a lean air-fuel mixture causes the engine to operate in a "lean burn" mode, and the engine produces what is called a "lean exhaust gas." JA2508, ¶ 16.

Although maintaining a high air-to-fuel ratio increased fuel efficiency, it also adversely affected the effectiveness of certain exhaust gas purification system components, such as three-way catalytic converters. JA2508, ¶ 17 (citing JA2257, col. 1, ll. 25-31). Specifically, the three-way converters were not able to effectively remove the NO_x present in the lean exhaust gas, which were emitted into the atmosphere. JA2508, ¶ 17 (citing JA2257, col. 1, ll. 25-31).

To address the effect of lean exhaust gases, it was known to modify the engine exhaust gas stream so that it alternately produced lean and rich exhaust gases. JA2508, ¶ 18 (citing JA2258, col. 3, ll. 21-22).

It was also known to switch between lean and rich exhaust gases in an automobile exhaust gas system that included a nitrogen oxide storage catalytic converter and a downstream NH_3 adsorbing-denitrating catalyst, also known as a selective catalytic reduction catalytic converter ("SCR catalytic converter"). JA2508, ¶ 19 (citing, e.g., JA2228, Fig. 1). An example of such an arrangement is illustrated below.



JA2508.

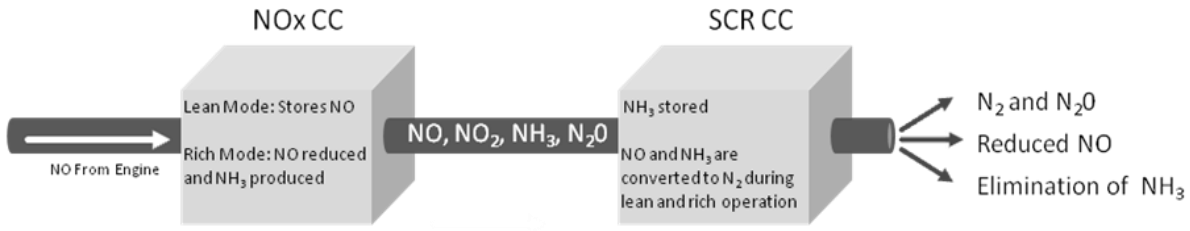
The NO_x catalytic converter – which is also commonly referred to as a "NO_x trap," "NO_x adsorber," "lean NO_x trap," "NO_x absorber," "NO_x absorbent," or "LNT" – adsorbs, absorbs, or traps NO_x produced during the lean mode operation (*i.e.*, when the exhaust gas has a high oxygen content) and releases stored NO_x during the rich mode of operation. JA2509, ¶ 20 – JA2510, ¶ 23; JA0010.

Once the NO_x catalytic converter is filled with NO_x, the engine is switched to a rich mode of operation. JA2510, ¶ 24. This is commonly referred to as regenerating the NO_x catalytic converter. *Id.* In this rich mode of operation, the NO_x catalytic converter is supplied with an exhaust gas having a large amount of NO_x reducing agents (*i.e.*, an excess of reducing constituents) to reduce the NO_x stored in the NO_x catalytic converter. *Id*. ¶ 26.

During this process, much of the NO_x is converted into ammonia (NH_3). *Id*. ¶ ¶ 27. Because it is undesirable to release ammonia into the atmosphere, an SCR catalytic converter is positioned downstream from the NO_x catalytic converter and functions to adsorb and store the ammonia produced during the rich cycle. *Id*. ¶ 28. The ammonia stored in the SCR catalytic converter reacts with any excess NO_x received from the upstream NO_x catalytic converter to produce N_2, a relatively harmless gas, for release into the atmosphere. *Id*. ¶ 29.

Once the NO_x catalytic converter is regenerated, the engine is switched back to lean mode and the engine continues to operate in this lean/rich cycle. *Id.* ¶ 30.

The conversion of NO_x to N_2 during the lean/rich process is depicted below.



JA2511.

Finally, it was known that catalytic exhaust gas system components, such as NO_x and SCR catalytic converters, do not lower the levels of carbon particulates in exhaust gases and that particulate filters must be used for this purpose. JA0094, col. 3, ll. 29-31.

B. Problems with the Prior Art

The efficiency of exhaust gas purification components, such as NO_x catalytic converters and SCR catalytic converters, depends upon the exhaust gas composition and temperature. JA2511, ¶ 33. Without rich exhaust gas compositions, the NO_x catalytic converter cannot be regenerated, NO will pass downstream without being reduced, and the NO_x catalytic converter will not generate a sufficient amount of ammonia for the SCR catalytic converter to reduce NO and ammonia to N_2. *Id.* Further, when temperatures are too low or too high,

exhaust gas purification components may not be able to remove all of the exhaust gas pollutants to comply with applicable government regulations; this is critical with respect to modern diesel engines, which operate at a lower temperature and produce exhaust gas at a corresponding lower temperature than older diesel engines. *Id.*

At low temperatures, it is also difficult for the NO_x catalytic converter to oxidize NO to form NO_2. *Id.* ¶ 34 (citing JA0093, col. 2, ll. 19-23). At high temperatures, the nitrates formed in the NO_x catalytic converter can no longer be stably stored in significant quantities, and the thermodynamic equilibrium between NO and NO_2 increasingly shifts toward nitrogen monoxide. JA2511-12, ¶ 34 (citing JA0093, col. 2, ll. 19-23). Thus, NO_x catalytic converters are typically most efficient at lowering nitrogen oxide levels within a relatively narrow temperature range of approximately 200 °C to 400 °C. JA2512, ¶ 34 (citing JA0093, col. 2, ll. 16-19). High temperatures affect not only the instantaneous operating efficiency of exhaust gas purification components, but can also cause thermal aging, which affects future efficiency of the components. JA2514, ¶ 34.

The efficiency of SCR catalytic converters is highly dependent on the NO/NO_2 ratio at low temperatures with a maximum efficiency at an NO_2 level of approximately 50% for temperatures below 200 °C, with greatly reduced efficiency if the NO_2 level is lower. JA2514, ¶ 35 (citing JA0093, col. 2, ll. 48-52). At

temperatures higher than 400 °C, the nitrogen oxide reduction of the SCR catalytic converter is limited by oxidation of ammonia. JA2514, ¶ 35 (citing JA0093, col. 2, ll. 52-54). As temperatures rise above 400 °C, ammonia storage capacity of the SCR catalytic converter decreases. JA2514, ¶ 35 (citing JA0093, col. 2, ll. 54-56). At low temperatures, SCR catalytic converters may also temporarily store unburnt hydrocarbons, and may oxidize hydrocarbons even when the exhaust gas composition is rich, particularly when vanadium oxide is the catalytic material. JA2514, ¶ 35 (citing JA0093, col. 2, ll. 62-67). Additionally, SCR catalytic converters are subject to thermal aging and should not be exposed to temperatures of over approximately 700 °C to 750 °C. JA2514, ¶ 35 (citing JA0093, col. 2, ll. 60-62). Accordingly, SCR catalytic converters operate most efficiently with lower levels of nitrogen oxides and in a temperature range between approximately 250 °C and 550 °C. JA2514, ¶ 35 (citing JA0093, col. 2, ll. 56-60).

As stated above, the NO_x storage catalytic converter can be designed to form ammonia when the engine is briefly operated under rich-burn conditions. JA0094, col. 3, ll. 21-25. With this type of internal generation of ammonia, there is a risk that the quantity of ammonia generated will exceed the ammonia storage capacity of the SCR catalytic converter, resulting in undesirable ammonia slippage (*i.e.*, emission into the atmosphere). *Id.*, col. 3, ll. 25-28.

Efficient operation of particulate filters is also subject to constraints on exhaust gas composition and temperature. Specifically, the particulates retained by a particulate filter must be burnt off at regular intervals by increasing the temperature above 600 °C or by using the so-called CRT effect when the exhaust gas has sufficient amount of NO_2, in which case the particulates can be removed with a temperature range between 250 °C and 400 °C. JA0095, col. 6, ll. 10-18.

II. The Bandl-Konrad '747 Patent

A. The Disclosure of the Bandl-Konrad '747 Patent

The Bandl-Konrad '747 patent provides a solution to the various problems described above. In particular, the Bandl-Konrad '747 patent discloses an exhaust gas aftertreatment installation and method that achieves several benefits: effective reduction of nitrogen oxides in a wide temperature range, avoidance of ammonia and hydrogen sulfide emissions, minimal particulate emissions, particulate oxidation through NO_2 reaction, minimal carbon monoxide and hydrocarbon emissions, relatively low thermal loading of all the components used to purify the exhaust gas, minimal increased fuel consumption, and a low demand for installation space. JA0094, col. 4, ll. 5-17.

The Bandl-Konrad '747 patent discloses, among other embodiments, an exhaust gas aftertreatment installation and method involving, in the order of the exhaust flow, an oxidation catalytic converter, an LNT, a particulate filter, and an

SCR catalytic converter. JA0089, Fig. 2; JA0092, Fig. 6; JA0094, col. 4, ll. 59-64; JA0099, col. 14, l. 38 – JA0100, col. 15, l. 34; JA0100, col. 16, ll. 14-18. This arrangement effectively reduces exhaust gas pollutants by, *inter alia*, controlling the exhaust gas composition supplied to the LNT and SCR catalytic converter and controlling the temperature of the SCR catalytic converter. JA0094, col. 4, l. 59 – JA0095, col. 5, l. 17; JA2400, ¶ 41.

The engine first delivers the exhaust gas to an oxidation catalytic converter, which oxidizes the carbon monoxide and hydrocarbons to form CO_2 and water, and some of the NO_x is oxidized to form NO_2. *Id.*

The exhaust gas from the oxidation catalytic converter is then supplied to an LNT, which further lowers the levels of NO_x in the exhaust gas. JA0092, Fig. 6; JA0100, col. 16, ll. 14-18. When exposed to exhaust gas having a high oxygen content (*i.e.*, the lean-burn mode), the LNT oxidizes NO to form NO_2, which is stored by the LNT. JA0093, col. 1, ll. 35-40. During brief, periodic regeneration phases, the LNT is exposed to an exhaust gas having a low oxygen content (*i.e.*, the rich-burn mode), and the LNT produces ammonia. JA0093, col. 1, l. 46 – JA0094 at col. 2, l. 3.

The exhaust gas is then passed to a particulate filter, which uses the NO_2 in the exhaust gas to oxidize carbon particulates in the exhaust gas. JA0099, col. 14, ll. 49-53.

The exhaust gas passes from the particulate filter to the SCR catalytic converter, which stores ammonia generated by the LNT and uses the stored ammonia to reduce the NO_x in the exhaust stream. JA0097, col. 9, ll. 35-37.

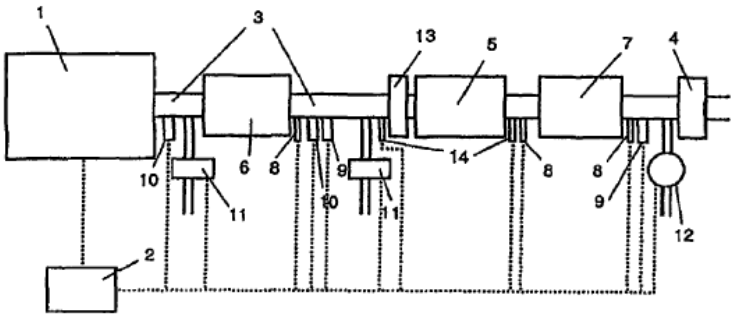
In an optional aspect of the invention, the exhaust gas from the LNT passes to an NO_2 producing catalytic converter, which increases the level of NO_2 to be used by the downstream particulate filter and SCR catalytic converter. JA0099, col. 14, ll. 44-49. This particular arrangement of the NO_2 producing catalytic converter and filter between the LNT and the SCR catalytic converter provides further advantages over prior art techniques. The NO_2 generated by the NO_2 producing catalytic converter allows soot to be burnt off of the particulate filter at temperatures as low 250 °C to 400 °C; otherwise, in the absence of NO_2, the temperature of the particulate filter must reach 600 °C to burn off the soot. JA0095, col. 6, ll. 12-18. The additional NO_2 also increases the efficiency of the downstream SCR catalytic converter. JA0099, col. 14, ll. 49-53.

This arrangement also allows the NO_2 producing catalytic converter and filter to control the temperature of the SCR catalytic converter by acting as heat sinks to reduce the thermal aging of the SCR catalytic converter caused by the high temperatures required for desulfation of the NO_x storage catalytic converter. JA0100, col. 15, ll. 17-24. By virtue of its high heat capacity, the filter stabilizes the temperature of the SCR catalytic converter even when the driving operation of

the vehicle is not in a steady state; this maintains the SCR catalytic converter in the required temperature range for efficient operation. *Id*. col. 15, ll. 24-32. The arrangement of the filter also protects the SCR catalytic converter from rapid increases in temperature that could result in undesirable desorption of stored NH_3. *Id*. col. 15, ll. 32-34.

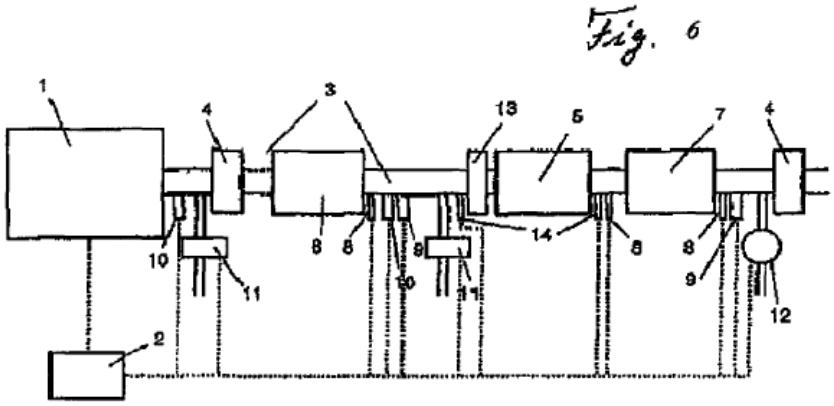
Figure 2 of the Bandl-Konrad ‘747 patent (reproduced below) depicts the following exhaust gas aftertreatment components connected in series and arranged in a particular order: an LNT 6, a particulate filter 5, an SCR catalytic converter 7, and an oxidation catalytic converter 4.

Fig. 2



JA0089.

The Bandl-Konrad ‘747 patent also discloses that an additional oxidation catalytic converter 4 can be connected upstream of the LNT 6, as depicted in Figure 6 (reproduced below).



JA0092.

B. The Claims of the Bandl-Konrad ‘747 Patent

Claim 1 of the Bandl-Konrad ‘747 patent recites:

> An installation for aftertreatment of exhaust gas generated by a diesel engine of a motor vehicle, said installation comprising:
>
> a nitrogen oxide storage catalytic converter configured for temporarily storing nitrogen oxides contained in the exhaust gas during adsorption operating phases with a lean exhaust gas air ratio and, releasing and reducing stored nitrogen oxides during regeneration operating phases with a rich exhaust gas air ratio;
>
> an SCR catalytic converter arranged downstream of the nitrogen oxide storage catalytic converter, said SCR catalytic converter being configured to receive and store ammonia generated by the nitrogen oxide storage catalytic converter, and to reduce nitrogen oxides in the exhaust gas with the stored ammonia;
>
> a particulate filter arranged upstream of the SCR catalytic converter and downstream of the nitrogen oxide storage catalytic converter; and

> an oxidation catalytic converter arranged as a first exhaust gas aftertreatment component, as seen in the direction of flow of the exhaust gas.

JA0102-03, claim 1.

Claims 2-8 and 19 depend either directly or indirectly from independent claim 1. Claim 2 further recites that the "particulate filter has a catalytic coating." JA0103, claim 2. Claim 3 further recites "an NO_2 producing catalytic converter disposed upstream of the SCR catalytic converter." *Id*., claim 3. Claim 4 further recites "a reducing agent supplying device configured to feed fuel into the exhaust gas stream, as a reducing agent." *Id*., claim 4. Claim 5 further recites that the "reducing agent supplying device is configured to feed fuel into the exhaust gas stream upstream of the particulate filter." *Id*., claim 5. Claim 6 further recites that the "oxidation catalytic converter is arranged close to the engine." *Id*., claim 6. Claim 7 further recites "comprising means for recording the NO_x content in the exhaust gas downstream of the nitrogen oxide storage catalytic converter and/or downstream of the SCR catalytic converter." *Id*., claim 7. Claim 8 further recites "comprising a lambda sensor arranged between the nitrogen oxide storage catalytic converter and the particulate filter." *Id*., claim 8. Claim 19 further recites "comprising an additional oxidation catalytic converter arranged downstream of the SCR catalytic converter." *Id*., claim 19.

Claims 10, 16, and 17 of the Bandl-Konrad '747 are method claims depending from independent method claim 9. *Id*., claim 10, 16, 17. Claim 10 recites that the method of claim 9 further comprises "filtering out particulates in the exhaust gas with a particulate filter arranged downstream of the nitrogen oxide storage catalytic converter and guiding filtered exhaust gas to the SCR catalytic converter." *Id*., claim 10. Claim 16 depends from method claim 10 and further recites "comprising performing from time to time a regeneration of the particulate filter." *Id*., claim 16. Claim 17 depends on claim 16 and further recites "an afterinjection of fuel is performed during the regeneration phases." *Id*., claim 17.

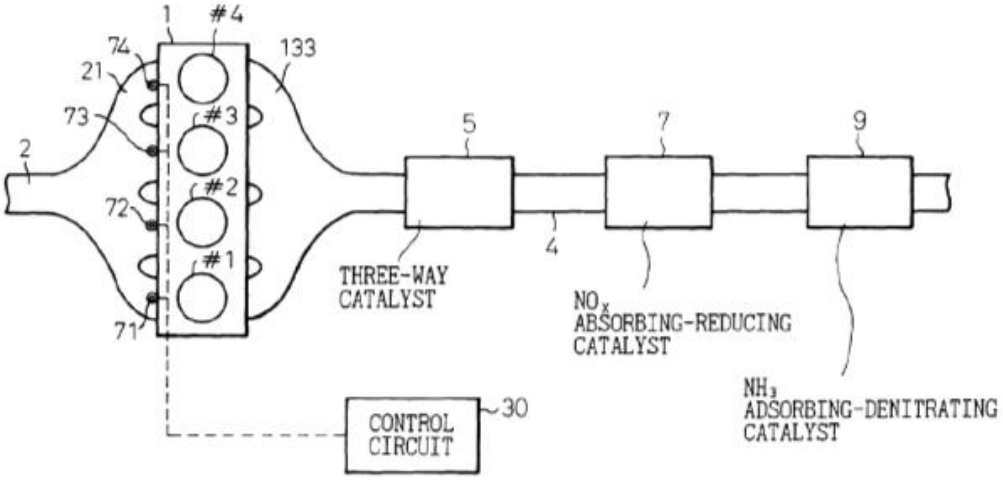
III. The Prior Art

The prior art discussed below includes references cited by Bandl-Konrad against claims of the Gandhi '558 application, as well as references Gandhi has cited against claims of the Bandl-Konrad '747 patent. As described in this section, as well as in the Argument set forth below, none of these references disclose or suggest – either alone or in combination – the subject matter of claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 patent.

A. The Kinugasa '024 Patent

U.S. Patent No. 6,109,024 (the "Kinugasa '024 patent") discloses an exhaust gas purification system for an internal combustion engine. JA2257, col. 1, ll. 7-8. Figure 1 of the Kinugasa '024 patent (reproduced below) illustrates a system using

the following components, in the direction of the exhaust gas flow from engine 1: a three-way catalyst 5, a NO_x absorbing-reducing catalyst 7, and a NH_3 adsorbing-denitrating catalyst 9. JA2228.



The Kinugasa '024 patent is different from the Bandl-Konrad claims at issue at least because it does not disclose a particulate filter between an LNT (the NO_x absorbing-reducing catalyst) and an SCR catalyst (the NH_3 adsorbing-denitrating catalyst). JA2226-73.

B. The Andreasson '809 Publication

International Patent Publication No. 99/39809 (the "Andreasson '809 publication") discloses and claims a system for selective catalytic reduction of NO_x in diesel engine exhaust or other lean exhaust gases. JA1239. The Andreasson '809 publication discloses a specific sequence of exhaust gas purification components – that is directed to a different solution than the Bandl-Konrad invention – that reduce NO_x: an oxidation catalyst followed by a particulate trap,

and then an SCR catalyst. JA1241, col., ll. 22-25; JA1247, claim 1, ll. 3-6.[3] The oxidation catalyst converts NO to NO_2, which is used to combust soot particle accumulated on the particle trap. JA1241, ll. 22-25; JA1244, ll. 12-14. Cooling means are provided upstream of the SCR catalyst to avoid temperatures greater than 500 °C, which can deactivate the SCR catalyst. JA1243, ll. 19-25.

Unlike the Bandl-Konrad '747 patent, the Andreasson '809 publication does not disclose an LNT. JA1239-55.

C. The Tennison '806 Patent

U.S. Patent No. 6,928,806 ("the Tennison '806 patent") is assigned on its face to Ford Global Technologies, LLC, the assignee of the Gandhi '558 application, and names as a joint inventor Robert Henry Hammerle, who is also a joint inventor of the Gandhi '558 application. JA2088; JA1203. The Tennison '806 patent noted several disadvantages of the arrangement in the Andreasson '809 publication in which an oxidation catalyst is followed by a particulate filter and an SCR catalyst: significant delay in achieving light-off temperatures necessary for efficiently eliminating NO_x due to the SCR catalyst being located farthest downstream, an additional cooling mechanism to avoid irreversible damage to the SCR catalyst from the high temperatures required to regenerate the particulate

[3] U.S. Patent No. 8,480,986 and U.S. Patent No. 7,498,010 are based on a National Stage application of the Andreasson '809 publication and recite a method with the same specific order of exhaust gas purification components.

filter, and emission of unused ammonia by the SCR catalyst into the atmosphere. JA2103, col. 1, ll. 30-50.

To overcome these purported disadvantages of the Andreasson '809 publication, the Tennison '806 patent discloses a different configuration that is also directed to a different solution than Bandl-Konrad's invention: moving the particulate filter from between the oxidation catalyst and the SCR catalyst to a position downstream from the SCR catalyst. *Id*. col. 1, ll. 51-62. For example, Figure 2A of the Tennison '806 patent (reproduced below) discloses that an SCR catalyst that is higher upstream than in the system disclosed in the Andreasson '809 application converts NO_x more efficiently, whereas a particulate filter that is downstream of the SCR catalyst eliminates the risk of thermal damage to the emission system components that otherwise would occur during filter regeneration. *Id*. col. 2, ll. 8-16; *see also* JA2104, col. 4, ll. 19-25, 39-49.

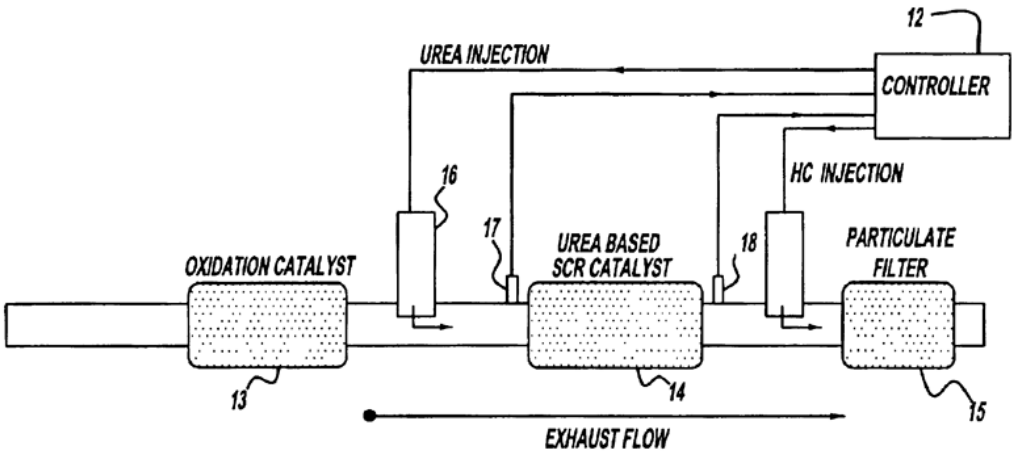
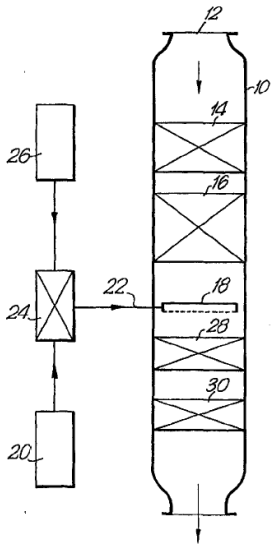


Figure - 2A

D. The Twigg ‘647 Publication



International Publication No. 00/21647 (the “Twigg ‘647 publication”) discloses an apparatus for treating engine exhaust gas using a particular arrangement of exhaust gas purification components. JA2482, Abstract. As can be seen in the sole figure of the Twigg ‘647 publication (reproduced on the right), the disclosure of the Twigg ‘647 publication is also different than the Bandl-Konrad invention. Specifically, the exhaust gas flows through a specific arrangement of components that includes an oxidation catalyst 14 that converts NO to NO_2, a filter 16 that combusts trapped soot using the NO_2, a NO_x absorber 28 that substantially removes the NO_x in the exhaust gas, and a three-way (or SCR) catalyst 30 that converts any remaining NO_x into a non-polluting gas. JA2490, l. 24 – JA2491, l. 16.

The Twigg ‘647 publication does not disclose a particulate filter arranged between an LNT and an SCR catalytic converter. JA2482-501.

E. The Gandhi '470 Application

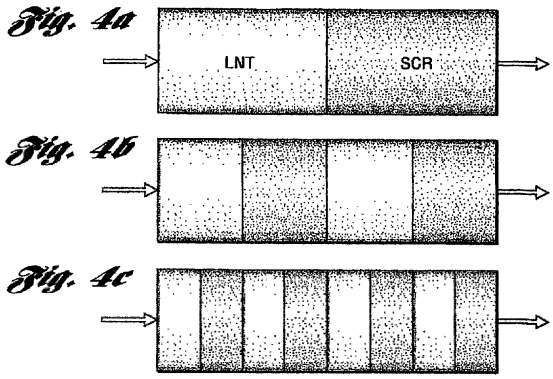
U.S. Patent Application Serial No. 10/065,470 is the great-grandparent of the Gandhi '558 application, and was published as U.S. Patent Application No. 2004/0076565 (the "Gandhi '470 application").[4] JA0104, ¶ [0001]; JA1203.

The Gandhi '470 application discloses and claims specific arrangements involving an LNT and an SCR catalyst. JA1205, Fig. 2; JA1213, ¶ [0033]; JA1216, claim 1; JA1217, claim 30; JA1218, claim 36. The Gandhi '470 application issued as U.S. Patent No. 7,332,135, containing claims 1 and 29, each of which recites an arrangement of two exhaust gas purification components, an LNT optimized for NH_3 generation and a downstream SCR catalyst. U.S. Patent No. 7,485,273 issued from an application that is the grandparent of the Gandhi '558 application; that patent includes claim 2, which recites a specific arrangement of two exhaust gas purification components, an ammonia generating device and a downstream NO_x removing device.

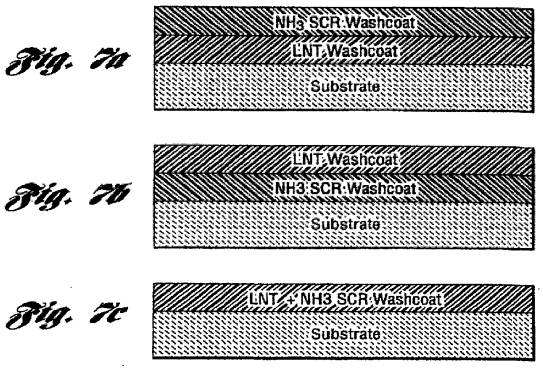
One embodiment (illustrated in Figures 4a-4c, which is reproduced below) is an integrated zone catalyst system that has alternating zones of an LNT and an

[4] Gandhi and the PTAB use the term "Gandhi '470 application" as shorthand for both U.S. Patent Application No. 10/065,470 and the publication thereof, U.S. Patent Publication No. 2004/0076565. Gandhi also refers to the "Gandhi '470 application" when citing to U.S. Patent Publication No. 2004/0076565. Although Bandl-Konrad disputes the characterization of a patent application as prior art, as only the publication of the application can be prior art, Bandl-Konrad uses the same nomenclature for the convenience of the Court.

SCR catalyst in the direction of the exhaust gas flow. JA1206; JA1214, ¶ [0045]. Unlike the Bandl-Konrad invention, the Gandhi '470 application discloses that having the LNT and SCR catalyst immediately adjacent to one another prevents undesirable conversion of the ammonia back to NO_x. JA1215, ¶ [0047].



Another embodiment (illustrated in Figures 7a-7c, which is reproduced below) involves an LNT and an SCR catalyst as washcoats arranged in parallel with respect to the exhaust gas flow, as opposed to the series arrangements disclosed in Figures 4a-4c. JA1209. Unlike the Bandl-Konrad invention, the Gandhi '470 application discloses that, as washcoats, the LNT and SCR catalyst can be incorporated into a porous substrate used for filtering particulate matter. JA1215, ¶ [0053]. This disclosure is the only mention of particulate filtering in the Gandhi '470 application. JA0065; JA1153; JA1203-18; JA2406. According to the Gandhi '470 application, the incorporation of an LNT and an SCR catalyst into a single substrate significantly reduces costs. JA1216, ¶ [0056].



The Gandhi ‘470 application is completely different from the Bandl-Konrad claims at issue: among other differences, it does not disclose a particulate filter arranged between an LNT or an SCR catalytic converter. JA0065; JA1203-18.

F. The Khair ‘096 Patent

U.S. Patent No. 6,293,096 (the “Khair ‘096 patent”) discloses and claims an exhaust gas aftertreatment system with very specific arrangements of just three exhaust gas purification components. JA1219, Abstract; JA1225-26, claims 1, 8, 15. The Khair ‘096 patent discloses two distinct embodiments for arranging these three exhaust gas purification components, neither of which is related to Bandl-Konrad’s claimed invention. Both embodiments are illustrated in Figures 1 and 2, reproduced and annotated below.

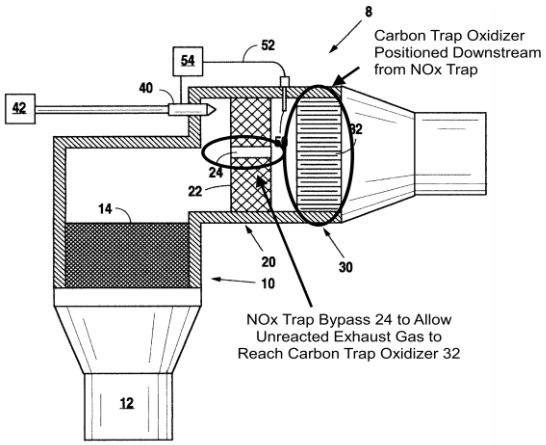


Fig. 1

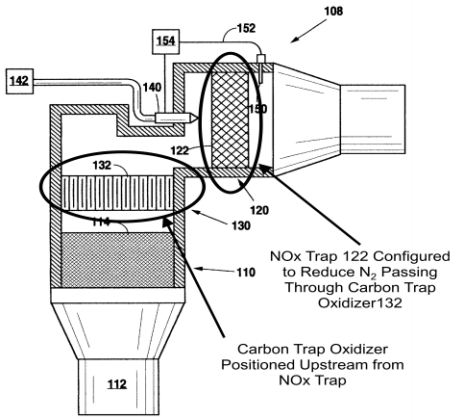


Fig. 2

JA2689, ¶ 24.

As illustrated in Figure 1, the first embodiment includes, in order of the direction of the exhaust gas flow, an oxidation catalyst 14, a lean NO_x trap 22, and a carbon trap oxidizer 32. JA1220, Fig. 1; JA1223, col. 4, ll. 28-31, 39-43; JA1224, col. 5, ll. 4-6. The lean NO_x trap 22 is provided with a bypass 24 to allow NO_2 to reach the carbon trap oxidizer 32. *Id*. col. 5, ll. 8-13. The carbon trap oxidizer 32 oxidizes the carbon to CO_2 and reduces any unconverted and bypassed NO_2 to N_2. *Id*. col. 5, ll. 7-13.

As illustrated in Figure 2, in the second embodiment, the carbon trap oxidizer 132 is arranged upstream of the NO_x trap 122. JA1221, Fig. 2; JA1224, col. 5, ll. 55-59. The carbon trap oxidizer 132 receives a gas stream containing NO_2, reduces a portion of the NO_2 to N_2, and oxidizes carbon to form CO_2. JA1219; JA1224, col. 6, ll. 3-8. The amount of NO_2 that is reduced to N_2 depends upon the amount of carbon in the carbon trap oxidizer 132. JA1224, col. 6, ll. 8-

10. The NO_x trap 122 is arranged downstream of the carbon trap oxidizer 132 to reduce any NO_2 that passes through the carbon trap oxidizer 132. *Id*. col. 6, ll. 16-27.

The Khair '096 patent also has significant differences with the Bandl-Konrad patent. Among other things, Khair does not disclose a particulate filter arranged between an LNT and an SCR catalytic converter. JA0068; JA1219-26.

IV. Proceedings Below

A. Each of Gandhi's Application Claims Was Found Unpatentable.

On February 14, 2011, Gandhi submitted an Amendment to the '558 application adding claims 11-49, which were substantially copied from the claims of the Bandl-Konrad '747 patent. JA2464-71; JA0020. Added independent claim 11 was identical to claim 1 of the Bandl-Konrad '747 patent. *Compare* JA2464-65, new claim 11 *with* JA0102-03, claim 1. Added dependent claim 20 was copied from dependent claim 10 of the Bandl-Konrad '747 patent. *Compare* JA2466, new claim 20 *with* JA0103, claim 10.

Dependent claim 20 was rejected by the Examiner for lack of written description under 35 U.S.C. § 112, ¶ 1, and Gandhi filed a Reply on July 25, 2011, arguing that the arrangement of the particulate filter in dependent claim 20 was supported by the disclosure in ¶ [0052] of the Gandhi '558 application and the corresponding disclosure in Gandhi U.S. Patent No. 7,332,135. The Examiner was

persuaded by Gandhi's arguments regarding written description support for dependent claim 20 and issued a communication on August 1, 2011, allowing all of the claims pending at that time in the Gandhi '558 application.

During the interference proceedings, Gandhi presented attorney argument and expert testimony that the Gandhi '558 application contained written description support for a particulate filter, and more specifically for a particulate filter arranged between a lean NO_x trap and an SCR catalytic converter. JA2447. Gandhi also argued and presented expert testimony that the Gandhi '470 application disclosed filtering particulates in combination with an LNT and SCR catalytic converter. JA0350.

The PTAB determined that Gandhi had no patentable claims. JA0071. Specifically, the PTAB concluded that claims 11-13 and 20 of Gandhi '558 application lacked written description support for a particulate filter arranged between two catalytic converters. JA0036; JA0072. The PTAB also concluded that claims 9, 19, 28, 30, 32, 33, 35, 46, 48, and 49 of the Gandhi '558 application are anticipated by the Kinugasa '024 patent, and claims 10, 31, 34, and 47 of the Gandhi '558 application are rendered obvious by the combination of the Kinugasa '024 patent and the Twigg '647 application. JA0049-52; JA0072. Gandhi has conceded that the PTAB's analysis was correct by not appealing these determinations by the PTAB.

B. The PTAB Concluded That Claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 Are Patentable.

The PTAB found that Bandl-Konrad successfully rebutted the presumption under 37 C.F.R. § 41.207(c) that claims 1-8, 10, 15-17, and 19 of the Bandl-Konrad '747 patent are unpatentable over the combination of the Kinugasa '024 patent and the Twigg '647 publication, and that Gandhi had not met its burden in establishing that the combination of the Gandhi '470 application and the Khair '096 patent rendered unpatentable claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 patent. JA0071.

SUMMARY OF THE ARGUMENT

Claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 patent recite systems and methods for treatment of exhaust gas using a specific arrangement of exhaust gas treatment components. The PTAB concluded—and Gandhi does not dispute—that the prior art fails to disclose a particulate filter arranged upstream of an SCR catalytic converter and downstream of an LNT as required by claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 patent. In fact, the prior art teaches away from this arrangement.

Exhaust gas aftertreatment components are not simple mechanical devices that can be arbitrarily arranged. As described in the Bandl-Konrad '747 patent, and as acknowledged by Gandhi's own expert, Dr. Michael Harold, these components can operate efficiently only when exposed to defined chemical

compositions within defined temperature ranges. JA3120-38. Given the cost and available space considerations when designing an exhaust gas aftertreatment system, there will always be a limited number of locations in which these components can be arranged. Notwithstanding the limited number of options for arranging known exhaust gas aftertreatment components, the U.S. Patent and Trademark Office ("USPTO") has issued numerous patents directed to very specific arrangements of known exhaust gas aftertreatment components. Indeed, Gandhi has obtained patents to a particular arrangement of just two aftertreatment components.

In an attempt to prevent Bandl-Konrad from maintaining its patent claims, Gandhi has misleadingly focused its obviousness analysis on an element-by-element comparison of known exhaust gas aftertreatment components, with a particular focus on the location of the claimed particulate filter. Gandhi's approach is legally impermissible as it ignores not only Bandl-Konrad's invention as a whole but also the prior art teachings that would lead one of ordinary skill in the art away from utilitzing the particular placement of the particulate filter claimed by Bandl-Konrad.

The PTAB correctly found that, with respect to claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 patent, Bandl-Konrad had rebutted the presumption of unpatentability under 37 C.F.R. § 41.207(c) in view of the combination of the

Kinugasa '024 patent and the Twigg '647 publication and that Gandhi had failed to meet its burden of proving that these claims were unpatentable in view of the combination of the Gandhi '470 application and the Khair '096 patent. When the claims and prior art are considered in their entirety, there is substantial evidence to support the PTAB's legal conclusion that claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 patent are patentable.

ARGUMENT

I. The PTAB Correctly Concluded That Claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 Patent Are Not Unpatentable.

A. Standard of Review

Whereas the Court reviews the PTAB's legal conclusion of obviousness without deference, it must uphold the PTAB's factual findings if they are supported by substantial evidence. *In re Gartside*, 203 F.3d 1305, 1315 (Fed. Cir. 2000); *see also Singh v. Brake*, 222 F.3d 1362, 1367 (Fed. Cir. 2000). Substantial evidence is something less than the weight of the evidence but "more than a mere scintilla" of evidence. *Gartside*, 203 F.3d at 1312. "[W]here two different, inconsistent conclusions may reasonably be drawn from the evidence in record, an agency's decision to favor one conclusion over the other is the epitome of a decision that must be sustained upon review for substantial evidence." *In re Jolley*, 308 F.3d 1317, 1329 (Fed. Cir. 2002); *see also Gartside*, 203 F.3d at 1312 (noting

that the possibility of drawing inconsistent conclusions from the evidence does not prevent the PTAB's findings from being supported by substantial evidence).

"Whether a claimed invention is unpatentable as obvious under § 103 is a question of law based on underlying findings of fact." *Gartside*, 203 F.3d at 1316. The scope and content of the prior art, as well as "[w]hat the prior art teaches and whether it teaches toward or away from the claimed invention," is a question of fact. *Para-Ordnance Mfg., Inc. v. SGS Imps. Int'l, Inc.*, 73 F.3d 1085, 1088 (Fed. Cir. 1995).

B. Bandl-Konrad Rebutted the Presumption under 37 C.F.R. § 41.207(c) Regarding the Patentability of Claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 Patent over the Kinugasa '024 Patent and the Twigg '647 Publication.

Each of claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 patent requires a specific arrangement of gas exhaust aftertreatment components in which a particulate filter is arranged upstream of the SCR catalytic converter and downstream of the nitrogen oxide storage catalytic converter. JA0102-03. The PTAB's findings of the disclosures in the Kinugasa '024 patent and the Twigg '647 publication – and the absence of any disclosure or suggestion in either of the specific arrangements required by the Bandl-Konrad claims – are supported by substantial evidence.

1. The Kinugasa '024 Patent and the Twigg '647 Publication Do Not Disclose or Suggest the Claimed Arrangement.

Both the Kinugasa '024 patent and the Twigg '647 publication disclose arrangements that are distinct from that required by the Bandl-Konrad claims. The Kinugasa '024 patent discloses an exhaust gas purification system including, in the direction of the exhaust gas flow, a three-way catalyst, a NO_x absorbing-reducing catalyst, and a NH_3 absorbing-denitrating catalyst. JA2228, Fig. 1; JA0039-40. The Twigg '647 publication generally discloses filtering to trap soot in the following sequence: an oxidation catalyst, a filter, a NO_x absorber, and a three-way catalyst. JA2482; JA2490, l. 24 – JA2491, l. 16.

More importantly, and as stated by Bandl-Konrad's expert, Dr. Oliver Kröcher, neither of these references – either alone or in combination – disclose or suggest, the following elements:

- a "particulate filter" arranged in a specific order, *i.e.*, "upstream of the SCR catalytic converter and downstream of the nitrogen oxide storage catalytic converter," as recited in Bandl-Konrad Claims 1-8 and 19 (*see* JA3082, ¶ 4); and
- "filtering out particulates in the exhaust gas with a particulate filter arranged downstream of the nitrogen oxide storage catalytic converter and guiding filtered exhaust gas to the SCR catalytic converter" as recited in Bandl-Konrad Claims 10, 16, and 17 (*id*., ¶ 5).

As the PTAB correctly noted, merely modifying the system in the Kinugasa '024 with the known "filtering" technique disclosed by the Twigg '647 publication

"would involve nothing more than an obvious combination of prior art elements according to known methods to yield predictable results." JA0054-55. But, as the PTAB stated in its decision, these references do not disclose or suggest the specific arrangement of "a particulate filter . . . 'arranged upstream of the SCR catalytic converter and downstream of the nitrogen oxide storage catalytic converter.'" *Id.*; JA0055.

Gandhi makes much of the fact that claims 9, 11-14, and 18 of the Bandl-Konrad '747 patent were determined to be unpatentable by the PTAB in view of the Kinugasa '024 patent and the Twigg '647 application.[5] App. Br. 26-28. This is a misdirection, however, as Gandhi has acknowledged that there is a "material difference" between the unpatentable claims and the patentable claims. *Id*. at 28. Specifically, none of claims 9, 11-14, and 18 recite the specific arrangement of gas exhaust aftertreatment components required by claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 patent.

Moreover, Gandhi improperly isolates the obviousness analysis to differences between the claimed invention and the prior art. Determining obviousness cannot be focused on such differences, but rather must be evaluated

[5] Gandhi mistakenly states that the PTAB determined that claim 15 is unpatentable over the Kinugasa '024 patent and the Twigg '647 publication. App. Br. 26-27. Rather, the PTAB concluded that Bandl-Konrad had established that the presumption of unpatentability does not apply to this claim. JA0055-56.

based on the claimed "subject matter as a whole." *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 1566 (Fed. Cir. 1987), *cert. denied*, 481 U.S. 1052 (1987). Indeed, the Federal Circuit has cautioned against the very analysis Gandhi insists upon here as impermissible "hindsight reasoning":

> Inventions typically are new combinations of existing principles or features. *The "as a whole" instruction in title 35 prevents evaluation of the invention part by part.* Without this important requirement, an obviousness assessment might break an invention into its component parts (A + B + C), then find a prior art reference containing A, another containing B, and another containing C, and on that basis alone declare the invention obvious. This form of hindsight reasoning, using the invention as a roadmap to find its prior art components, would discount the value of combining various existing features or principles in a new way to achieve a new result—often the very definition of invention.

Ruiz v. A.B. Chance Co., 357 F.3d 1270, 1275 (Fed. Cir. 2004) (emphasis added) (internal citations omitted).

In fact, in this technology area, those with ordinary skill in the art have sought patents on several specific combinations of known exhaust gas aftertreatment components, and some of those applications resulted in issued patents. For example, the named inventors on the Gandhi '558 application, each of whom is presumably of at least ordinary skill in the art, filed applications from which the Gandhi '470 application claims priority containing claims to a specific arrangement of just two known exhaust gas aftertreatment components, an LNT

and an SCR catalyst. JA1216, claim 1; JA1217, claim 30; JA1218, claim 36. Those claims were issued in U.S. Patent No. 7,332,135, with claims 1 and 29 reciting an arrangement of two exhaust gas purification components, an LNT optimized for NH_3 generation and a downstream SCR catalyst, and U.S. Patent No. 7,485,273, with claim 2 reciting a specific arrangement of two exhaust gas purification components, an ammonia generating device and a downstream NO_x removing device.[6] As another example, the named inventors of the Andreasson '809 publication sought a patent on a specific order of known exhaust gas aftertreatment components, namely an oxidation catalyst, particulate trap, and an SCR catalyst. JA1247, claim 1, ll. 3-6. That invention was allowed as claim 1 in both U.S. Patent No. 8,480,986 and U.S. Patent No. 7,498,010; claim 1 recites a method with the same specific order of exhaust gas purification components. And, as a third example, the Khair '096 patent issued with claims to a specific arrangement of an oxidation catalyst, an LNT, and a carbon trap. JA1225-26, claims 1, 8, 15.

[6] By submitting these claims with an executed inventor declaration, the named inventors on these applications represented to the USPTO that they believed a specific arrangement of two known exhaust gas aftertreatment components was patentable. JA1216, claim 1; JA1217, claim 30; JA1218, claim 36. This is contrary to the position that Gandhi takes now on appeal. *See* App. Br. 29.

For combinations of references such as these to render claims directed to a different apparatus obvious, "some suggestion or motivation, before the invention itself, to make the new combination" must be shown. *Ruiz*, 357 F.3d at 1275. That Gandhi has not done. As the PTAB correctly found, there is no factual evidence to support a "basis or articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." JA0055. Substantial evidence supports the PTAB's findings to the contrary: that neither the Kinugasa '024 patent nor the Twigg '647 publication disclose or suggest the placement of the particulate filter upstream of the SCR catalytic converter and downstream of the nitrogen oxide storage catalytic converter. JA0055.

2. Placing a Particulate Filter Upstream of the SCR Catalytic Converter and Downstream of an LNT Would Not Have Been Obvious to Try by One of Ordinary Skill in the Art.

An invention may be found obvious if it would have been obvious to a person having ordinary skill in the art to try. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 421 (2007). Even ignoring for a moment the full scope of Bandl-Konrad's claims, placing a particulate filter between an LNT and an SCR catalytic converter would not have been obvious to try at the time of Bandl-Konrad's invention: not only would one of ordinary skill in the art have faced various possible choices as to where to place a particulate filter in an exhaust gas aftertreatment installation, the prior art taught away, rather than guided toward, the

claimed arrangement. One of ordinary skill in the art would have recognized disadvantages of such an arrangement, including increased thermal aging due to the filter regeneration, the filter robbing the downstream SCR catalytic converter of NO_2 required for efficient operation of the SCR catalytic converter, and deactivation of the SCR catalyst. *See*, *e.g.*, JA0093, col. 2, ll. 56-62.

Contrary to the cases cited by Gandhi, the prior art here would not have "directed a person of ordinary skill in the art to two or three predictable solutions." App. Br. 29-30. To be sure, the Kinugasa '024 patent, in disclosing three components, with a three-way catalyst as the first exhaust gas aftertreatment component in the flow of the exhaust gas, presents at least four possible locations for the particulate filter. JA2228, Fig. 1; JA0049. In this arrangement, the particulate filter could be placed upstream of the first component, between the first and second component, between the second and third component, or downstream of the third component.

But the Gandhi '470 application demonstrates that there were far more than four possible places for a particulate filter. The Gandhi '470 application discloses incorporating LNT and SCR catalyst washcoats into porous substrates used for filtering particulate matter (JA1215, ¶ [0053]), which Gandhi repeatedly represented to the USPTO provided written description support for a particulate filter. *See*, *e.g.*, JA2447 ("Consequently . . . both the '135 patent and '558

application disclose a particulate filter downstream of the NO_x storage catalyst."). This disclosure in the Gandhi '470 application thus suggests several additional places where a particulate filter could be placed: it could be integrated with either the LNT, the SCR catalytic converter, or both. Because the Gandhi '470 application is prior art to the Bandl-Konrad '747 patent, one skilled in the art would have considered the additional locations of a particulate filter provided by the Gandhi '470 application.

Given these possible choices, one of ordinary skill in the art would have been directed to locations other than between the LNT and the SCR catalytic converter. As explained by Bandl-Konrad's expert, Dr. Kröcher, the more obvious place for a particulate filter was immediately after the engine:

> The specific position of the diesel particulate filter between the LNT and the ammonia-SCR catalyst is not obvious to someone of ordinary skill in the art, and it's also not obvious to an expert in the field because usually someone would try to put the diesel particulate filter as early as possible in the flow of exhaust gas stream. So coming very directly after the engine to use the high temperature in the exhaust gas for the regeneration of the particulates."

JA2075, ll. 8-19. Dr. Kröcher provided another reason for placing the particulate filter upstream in the exhaust gas flow:

> The NO_x absorbing and reducing catalyst produces NO_2 which helps for the past SCR reaction to proceed in the ammonia absorbing denitrating catalyst, and the diesel particulate catalyst consumes the NO_2 coming from the

> NO_x absorbing and reducing catalyst to oxidize the soot. So then there is no more NO_2 for the past SCR reaction to proceed in the SCR catalyst and, therefore, this is another reason why someone of ordinary skill in the art would have put diesel particulate filter upstream of the NO_x absorbing reducing catalyst.

JA2084, l. 16 – JA2085, l. 1.

Gandhi's expert, Dr. Harold, agreed. He testified that "a particulate filter close to the engine would have the advantage of, relatively speaking, a higher temperature exhaust" and that "[t]emperature is one of the variables that determines the light-off of the particulates, so the higher the exhaust temperature, the easier it is to light off the soot." JA3131, ll. 3-10.

In addition, those skilled in the art would have recognized significant disadvantages to placing a particulate filter upstream of an SCR catalytic converter. Those disadvantages included increased thermal aging due to the filter regeneration, the filter robbing the downstream SCR catalytic converter of NO_2 required for efficient operation of the SCR catalytic converter, and deactivation of the SCR catalyst. *See*, *e.g.*, JA0093, col. 2, ll. 56-62.

Regeneration of a particulate filter either requires exposing the particulate filter to temperatures in excess of 600 °C or using NO_2 with exhaust gas within a temperature range between 250 °C and 400 °C; these are non-optimal conditions for an SCR catalytic converter. JA0095, col. 6, ll. 12-18. Exposing the particulate filter to temperatures in excess of 600 °C can adversely affect the ammonia storage

capacity of the downstream SCR catalytic converter, which occurs as temperatures rise above 400 °C. JA0093, col. 2, ll. 54-56. Using NO_2 to regenerate a particulate filter upstream of an SCR catalytic converter reduces the NO_2 available to the SCR catalytic converter, the efficiency of which is greatly reduced when the NO_2 level decreases below 50%. *Id*. col. 2, ll. 48-52. Dr. Harold also testified to the concern of a particulate filter limiting the amount of NO_2 that could reach a downstream SCR catalytic converter:

> If a particulate filter is near an engine and it is followed by a NO_x reduction device like an SCR, one could argue that the DPF [diesel particulate filter] would rob the SCR of NO_2. And the context I'm speaking there is that it's well-known to people in the art, in terms of lighting off the soot . . . that in addition to temperature, one needs NO_2 to help that along, and NO_2 that's consumed by the DPF, the filter, to light off the soot would then not make its way to the downstream SCR.

JA3132, ll. 10-20.

Further, if the combustion of soot on the particulate filter increases the exhaust gas temperature provided to the SCR catalytic converter above approximately 700 °C to 750 °C, the SCR catalytic converter can be subject to thermal aging. JA0093, col. 2, ll. 60-62. Dr. Harold recognized this issue as well:

> Q. Okay. So if the temperature of the exhaust gas supplied to the SCR is above the temperature range where the SCR operates correctly, what would happen to the SCR?

A. Well, too high of a temperature can lead to degradation of the catalytic material.

Q. And that was known as of January of 2003?

A. Degradation of catalysts at high temperatures is a fairly well-known phenomenon.

Q. My specific question is: Degradation of the catalytic material in an SCR, was that known as of January of 2003 if the exhaust temperature was too high?

A. I can't speak that specifically to SCR, but materials that SCR are made out of can be prone to thermal degradation, so I can't answer your question specifically. I haven't looked at that issue specifically.

Q. You haven't looked at the issue of thermal degradation of SCR specifically; am I understanding that right?

A. Well, again, the materials that SCR catalysts comprise have the same feature of many emission catalysts, and that is at high temperature they can degrade, due to prolonged exposure to temperature, so that I can say more generally.

JA3123, l. 19 – JA3124, l. 22.

The thermal aging risk was significant enough that even one of the joint inventors of the Gandhi '558 application disclosed in the Tennison '806 patent a system to, *inter alia*, specifically avoid the thermal damage that would occur during filter regeneration. JA2103, col. 2, ll. 8-15; col. 4, ll. 19-25. That system involved a particulate filter placed downstream from the SCR catalyst. *Id*.

The evidence, including testimony of Gandhi's own expert, is clear that one skilled in the art would have considered arranging a particulate filter upstream of an SCR catalytic convert as having serious detrimental effects on the operation and longevity of the downstream SCR catalytic converter. Thus, one skilled in the art would not have chosen to place a particulate filter upstream of an SCR catalytic converter as required by Bandl-Konrad's claims. Accordingly, the PTAB correctly found that Bandl-Konrad successfully rebutted the presumption under 37 C.F.R. § 41.207(c) that claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 patent are unpatentable over the combination of the Kinugasa '024 patent and the Twigg '647 application.

C. Gandhi Failed to Satisfy Its Burden to Show That Bandl-Konrad Claims 1-8, 10, 16, 17, and 19 Are Unpatentable over the Gandhi '470 Application and the Khair '096 Patent.

The PTAB correctly found that Gandhi had not met its burden in establishing that the combination of the Gandhi '470 application and the Khair '096 patent renders claims 1 and 10 of the Bandl-Konrad '747 patent unpatentable. Substantial evidence supports the PTAB's findings that (1) both references fail to disclose or suggest a particulate filter arranged upstream of an SCR catalytic converter and downstream of an LNT and (2) the prior art would have directed one skilled in the art to not place a particulate filter upstream of an SCR catalytic converter.

1. The Gandhi '470 Application and the Khair '096 Patent Do Not Disclose or Suggest the Claimed Arrangement.

Neither the Gandhi '470 application nor the Khair '096 patent discloses a particulate filter arranged between an LNT and an SCR catalytic converter. Contrary to the repeated representations to the Examiner and the PTAB in the interference proceedings (JA0350; JA2447), Gandhi now contends that the Gandhi '565 application does not disclose a particulate filter and relies solely on a carbon trap disclosed in the Khair '096 patent for the teaching of a filter. App. Br. 32. But the Khair '096 patent does not disclose an SCR catalytic converter or the location of a particulate filter in relation to an SCR catalytic converter as required by the Bandl-Konrad claims. JA1219-26. Instead the Khair '096 patent discloses the placement of a carbon trap either downstream of the lean NO_x trap or downstream of the oxidation catalyst and upstream of the lean NO_x trap. JA1220, Fig. 1; JA1221, Fig. 2. Further, with respect to the first arrangement in which the carbon trap is downstream of the lean NO_x trap, the Khair '096 patent discloses that the carbon trap is the last exhaust gas purification component in the system. JA1221, Fig. 2; JA1225, claim 8.

Gandhi fails to provide any evidence as to why one of ordinary skill in the art would have been motivated to combine the carbon trap in the Khair '096 patent with the catalyst system in the Gandhi '470 application. As explained by Dr. Kröcher: "One skilled in the art would have seen no need to add an SCR catalytic

converter to the arrangement of Fig. 1 of Khair because the carbon trap oxidizer 32 already reduces the NO_x that slips from the lean NO_x trap 22 . . . ." JA2688-89, ¶ 22. The Khair '096 patent discloses that, in such an arrangement, "[t]he unconverted NO_2 from the first portion 22 of the second stage 20, as well as bypassed NO_2 passing through the second portion 24 of the second stage 22, is reduced to nitrogen and CO_2 . . . ." JA1224, col. 5, ll. 8-13.

In an attempt to sidestep the lack of disclosure in the Khair '096 patent, Gandhi relies upon an embodiment of the Khair '096 patent that "teaches that the removal of NO_x using the CRT function is limited by the amount of carbon present in the filter." App. Br. 34. Although the second embodiment involves a particulate filter placed upstream from the NO_x trap, Gandhi argues that the accompanying disclosure applies equally to the first embodiment where the particulate filter is placed downstream from the NO_x trap. *Id*. Gandhi's reasoning is that both embodiments apparently suffer from the same "problem" of "having unreacted NO_x pass through the filter." *Id*.

As an initial matter, Gandhi's understanding of the disclosures in the Khair '096 patent is wrong. Instead of "having unreacted NO_x pass through the filter," the Khair '096 patent expressly discloses that placing the particulate filter downstream from the NO_x trap – as required by Bandl-Konrad claims 1 and 10 – completely reduces the NO_2 to N_2:

> In the second stage 20, a lean NO_x trap stores the NO_2 formed by the oxidation catalyst 14 of the first stage 10. The stored NO_2 then combines with supplemental HC, injected by the injector 40 to form N_2, H_2O, and CO_2. Unconverted as well as bypassed NO_2 then proceed to the carbon trap oxidizer 32 of the third stage 30, where NO_2 is reduced to N_2 and carbon is oxidized to CO_2.

JA1224 at col. 5, ll. 18-25; *see also id*., col. 5:6-13. The NO_x removal by the filter thus is promoted by its particular location, rather than inhibited by the amount of carbon in the filter. Without any "unreacted NO_x pass[ing] through the filter" downstream from the lean NO_x trap, the Khair '096 patent provides no motivation to place a particulate filter upstream of the SCR catalytic converter and downstream of the LNT as required by the Bandl-Konrad claims at issue.

This first embodiment differs from the second embodiment in another important respect. As Dr. Kröcher noted, "the lean NO_x trap [in the first embodiment] is purposefully configured to allow exhaust gas to pass through unreacted (*i.e.*, via bypass 24)." JA2690, ¶ 26. This bypass provides a sufficient amount of unreacted NO_2 necessary for reduction of the carbon to CO_2. JA1223, col. 3, ll. 8-13. The second embodiment, in contrast, exposes NO_2 to the particulate filter before the lean NO_x trap, and the carbon-based particulate filter thus may not reduce all of the NO_2. JA1224, col. 6, ll. 1-15.

In addition, Gandhi now asserts reasons that are supposedly "independent from the motivation articulated in the testimony of Dr. Harold." App. Br. 34. But

those "independent" reasons simply repeat the testimony of Dr. Harold. *Compare id*. ("Namely, a person of ordinary skill in the art would have recognized that combining a particulate filter, as described in the Khair '096 patent with the exhaust gas purification system disclosed in the Gandhi '470 application would have presented only a small, finite number of options as to [the] location of the particulate filter.") *with* JA2111, ¶ 7 – JA2113, ¶ 11 (discussing "small, finite number of possible locations").

To the extent that this is a new argument presented by Gandhi, it is a legal conclusion without factual support. Contrary to Gandhi's assertions, the PTAB made a number of findings as to the disclosures in the Gandhi '470 application. It found not one arrangement, as Gandhi would like the Court to believe, but the following four arrangements: (1) a lean NO_x trap and an NH3-SCR catalyst; (2) a combination of a lean NO_x trap and an NH3-SCR catalyst arranged on a single substrate or a single catalytic converter can; (3) a combination of a lean NO_x trap and an NH3-SCR catalyst applied to a single substrate as washcoats; and (4) two three-way catalysts with a downstream NH3-SCR catalyst. JA0058-60. Based on these various disclosures, the options of where to place a particulate filter are not small or finite in number. Gandhi, however, improperly focuses on the first embodiment to the exclusion of the other three simply so that Gandhi could arrive at a "small, finite number of options."

Without expressly saying so, Gandhi cites to Dr. Harold's declaration that refers to specific disclosures made in the context of the third embodiment above. App. Br. 33 (citing JA1153-54, ¶ 29 (referring to "filtering particulates in combination with Lean NO_x Trap and SCR Catalyst Technology")). But, as recognized by the PTAB, Gandhi's assertions that it would have been obvious to add the particulate filter in the Khair '096 patent to the system referenced in the Gandhi '470 application are premised solely on lawyer argument and conclusory statements, which are entitled to little probative value. JA0067, ll. 16-20.

2. The Prior Art Teaches Away from Arranging a Particulate Filter between an LNT and an SCR Catalytic Converter.

The Gandhi '470 application itself contains a number of disclosures that would have discouraged one skilled in the art from incorporating a filter between the lean NO_x trap and the NH3-SCR catalytic converter. The disclosures relied upon by Bandl-Konrad and the PTAB below are directed to several embodiments disclosed in the Gandhi '470 application, not to a single embodiment. JA2699, ¶ 37 – JA2700, ¶ 39 (referring to three of the four embodiments in the Gandhi '470 application and one of the embodiments in the Khair '096 patent).

The PTAB considered Dr. Kröcher's declaration and correctly found that the Gandhi '470 application contained the following disclosures that would have "discouraged" one skilled in the art from arranging a particulate filter between an LNT and an SCR catalytic converter:

First, the Gandhi '470 application discloses that it is desirable to arrange the lean NO_x trap and SCR catalytic converter as close as possible to avoid unwanted conversion of ammonia back to NO_x . . . . Positioning a filter between the catalysts as required by Claim 1 would in fact be discouraged in view of the Gandhi '470 application because one skilled in the art would not have desired to reduce the amount of ammonia and increase the amount of NO_x that would occur due to an increased separation between the lean NO_x trap and SCR catalytic converter.

Second, arranging a particulate filter between the lean NO_x trap and the SCR catalytic converter would have increased the overall cost of the system because Gandhi discloses that configuring the lean NO_x trap and the SCR catalytic converter on a single substrate significantly reduces costs. *See, e.g.*, [JA1203], Gandhi '470 application, ¶ 0056 ("the incorporation of both a lean NO_x trap and NH3-SCR washcoat into a single substrate will significantly reduce substrate costs."). Indeed, since Gandhi contemplates incorporating the catalysts on a single substrate, there is no explanation as to how a particulate filter could be arranged upstream of an SCR catalytic converter and downstream of a NO_x catalytic converter in this way.

Third, arranging a particulate filter between the lean NO_x trap and the SCR catalytic converter would reduce the amount of NO_2 available for the SCR catalytic converter, which would have been undesirable because NO_2 promotes the operations of the SCR catalytic converter. The Khair '096 patent expressly discloses that the carbon trap oxidizer 32 reduces the amount of NO_2 . . . . Thus, one skilled in the art would not have combined the NO_2 reducing filter of the Khair '096 patent with the catalyst arrangement of the Gandhi '470 application as the operation of the SCR catalytic converter would be adversely affected.

JA0069-70 (citing JA2699, ¶ 37 – JA2700, ¶ 39).

Gandhi's reliance upon *In re Mouttet* and *Galderama Laboratories, L.P. v. Tolmar, Inc.* is thus misplaced. Unlike the disclosures in those cases, the prior art here does not involve the "mere disclosure of alternative designs" or an "optimal" teaching that "does not criticize, discredit, or otherwise discourage investigation into other compositions." *See In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012); *Galderama Labs., L.P. v. Tolmar, Inc.*, 737 F.3d 731, 739 (Fed. Cir. 2013).

Rather, the prior art teaches away and discourages a person of ordinary skill, upon reading the reference, "from following the path set out in the reference." *Mouttet*, 686 F.3d at 1333-34. For example, upon reading the Khair '096 patent, which expressly discloses that the carbon trap oxidizer reduces the amount of NO_2, one skilled in the art would be discouraged from adding a particulate filter between the lean NO_x trap and the SCR catalytic converter because it would reduce the amount of NO_2 available for the SCR catalytic converter, whereas NO_2 is needed to promote the operations of the SCR catalytic converter. JA2700, ¶ 39.

Though Gandhi suggests they exist, Gandhi cannot even identify any alternatives in the Gandhi '470 application that are "better," much less alternatives that would lead one of ordinary skill in the art to arrive at the claimed invention. App. Br. 38-39.

The PTAB correctly held that Gandhi failed to meet its burden in establishing the unpatentability of claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 patent based on the combination of the Gandhi '470 application and the Khair '096 patent. The Gandhi '470 application and the Khair '096 patent both fail to disclose or suggest arranging a particulate filter upstream of an SCR catalytic converter. Both references describe significant issues that would arise should a particulate filter be arranged in this manner. One skilled in the art would have recognized additional significant issues with this arrangement of a particulate filter.

CONCLUSION

For the reasons discussed above, the Court should affirm the PTAB's judgment that Bandl-Konrad rebutted the presumption under 37 C.F.R. § 41.207(c) and that Gandhi failed to meet its burden of proof that claims 1-8, 10, 16, 17, and 19 of the Bandl-Konrad '747 patent are unpatentable. The PTAB made these determinations based on factual findings on the scope and content of the prior art, including their teachings away from the claimed invention. Those findings are supported by substantial evidence and thus should be upheld.

February 27, 2014

Respectfully submitted,

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CERTIFICATE OF SERVICE

I certify that on this 27th day of February, 2014, the foregoing BRIEF OF APPELLEES was served on counsel of record by electronic means by email and CM/ECF.

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CERTIFICATE OF COMPLIANCE

I certify that the foregoing BRIEF OF APPELLEES complies with the type-volume limitation of Federal Rule of Appellate Procedure 32(a)(7)(B) and contains 10,503 words, excluding the parts of the brief exempted by Federal Rule of Appellate Procedure 32(a)(7)(B)(iii) and Federal Circuit Rule 32(b).

I further certify that this brief complies with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and the type style requirements of Federal Rule of Appellate Procedure 32(a)(6). The brief has been prepared in a proportionally spaced typeface using Microsoft Word in Times New Roman, 14 point.

February 27, 2014

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